TECHNICAL SPECIFICATIONS

INDEX TO
TECHNICAL SPECIFICATIONS
Miles City Fish Hatchery Liner Repairs

FWP# 7113103

DIVISION 1 GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Owner and Contractor Responsibilities

B. Contractor use of site and premises.

C. Scope of Work

1.2 Owner and Contractor Responsibilities

A. Owners Responsibilities:
   1. Provide staging area.
   2. Provide access to drain ponds.

B. Contractors Responsibilities:
   1. Furnish and Implement all work described in these documents.
   2. Coordination with FWP Engineer Kenneth Phillips, P.E.
   3. Any dewatering required for the work.

1.3 CONTRACTOR USE OF SITE

A. Limit use of site to allow:

   1. Coordinate with FWP to limit access in work areas as necessary.
   2. Maintain construction site free of debris and stage materials in areas approved by FWP personnel.
   3. Contractor access limited to Hatchery Pond area area denoted on plans.
   4. Contractor is not to obstruct any fish production activities

1.3 SCOPE OF WORK

A. Project Objective:-
The objective of this project is to repair or replace damaged hatchery liners. Regrade slumped pond wall areas and add geoweb for bank stabilization and reset liners.

B. Scope of Work:
Work includes the following but is not limited to the general description contained herein:

Remove and replace liners on half of ponds 18 & 20. Peel back liner from slumped area in ponds and place in geo stabilizing grids, and reset liner in ponds, 20, 23, 26, 27 & 28.

C. CONTRACTS:
All work shall be done under one general contract.

END OF SECTION

SECTION 01019 - CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Application for Payment
B. Change procedures
C. Environmental Considerations

1.2 RELATED SECTIONS

A. Section 01025 - Measurement and Payment.
B. Section 01400 - Quality Control

1.4 APPLICATIONS FOR PAYMENT

A. Submit 1 copy of each application on Department Fish, Wildlife and Parks Form 101.

B. Content and Format: Utilize Schedule of Values on proposal form for listing items in Application for Payment.

C. Payment Period: 30 days.

1.5 CHANGE ORDER PROCEDURES

A. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by State of Montana, General Conditions of the Contract.

B. The Engineer may issue a Change Directive, which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change. Contractor will prepare and submit an estimate within 5 days.

C. The Contractor may propose changes by submitting a request for change to the Engineer describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors.

D. Unit Price Change Order: For pre-determined unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units, which are not pre-determined, execute Work under a Construction Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.

1.6 ENVIRONMENTAL CONSIDERATIONS

All material removed from the site will be disposed of in a safe and legal manner.

END OF SECTION

SECTION 01025 - MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Measurement and payment criteria applicable to the Work performed under a unit price payment method.

B. Defect assessment and non-payment for rejected work.

1.2 AUTHORITY

A. Measurement methods delineated in the individual specification sections are intended to complement the criteria of this section. In the event of conflict, the requirements of the individual specification section shall govern.

B. Take all measurements and compute quantities. The Engineer will verify measurements and quantities.

1.3 UNIT QUANTITIES SPECIFIED

A. Lump sum bid item quantities will not be measured. Payment for these lump sum bid items will be per bid form.

B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.

1.4 MEASUREMENT OF QUANTITIES

A. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

B. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.5 PAYMENT

A. Payment Includes: Full compensation for all required labor, Products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1. Mobilization/Demobilization shall include all costs for general conditions, all transportation costs for equipment and job trailers to arrive/depart site. Any temporary offsite storage costs, demurrage, job cleanup and temporary facilities that the contractor needs to complete the work. Payment will be 65% of the lump sum bid for mobilization and 35% for demobilization.

2. Pond liner replacement ponds 18 & 20. Replace liner as noted on plans. Payment includes removing, salvaging and replacing road base, backfill and clay pond bottom

liner. Removal of old liner, replacing with new liner and all welding or joining
3. required for the complete installation of the new liner.

4. Repair slump in ponds 20,23,26,27, & 28. To include the salvage and replacement of road mix, and key backfill. The excavation of slumped material to a true angle of repose, Installation of cellular soil confinement systems and backfill with salvaged slumped material, re-grading and replacing liner, replacing and compacting road material disturbed by slump repair. It includes any patching, welding or kettle termination required for the complete reinstallation of liner over slumped area.

5. Miscellaneous liner tear repair is a per foot of existing tears in ponds not listed in the above pay items. This will include tear preparation, welding, liner material for patch and all work incidental for patching liners.

B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities accepted by the Architect/Engineer multiplied by the unit sum/price for Work which is incorporated in or made necessary by the Work.

1.6 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Engineer it is not practical to remove and replace the Work, the Engineer will direct one of the following remedies:

1. The defective Work will be repaired to the instructions of the Montana Department of Fish, Wildlife and Parks Engineer and the unit sum/price will be adjusted to a new sum/price at the discretion of the Montana Department of Fish, Wildlife and Parks Project Engineer.

2. The defective work will not be repaired. The Project Engineer will adjust the unit sum/price of the work to reflect the degree of defectiveness and subsequent serviceability.

C. The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction.

D. The authority of the Montana Department of Fish, Wildlife and Park Project Engineer to assess the defect and identify payment adjustment, is final.

1.7 NON-PAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for any of the following:
1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling and disposing of rejected Products.

END SECTION

SECTION 01029

UTILITIES WITHIN WORK AREAS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Utilities within work areas.

B. Contractor's responsibilities.

1.2 UTILITIES WITHIN WORK AREAS

A. The contractor shall be responsible for determining the location of any utilities in the project area.

B. The contractor shall be responsible for working safely around any utilities that are located within the project area.

1.3 CONTRACTOR RESPONSIBILITIES

A. Notification: The Contractor shall contact, in writing, all public and private utility companies that may have utilities that may be encountered during excavation. The notification shall include the following information:

1. The nature of the work the Contractor will be performing.

2. The time, date, and location the Contractor will be performing work that may conflict with the utility.

3. The nature of work the utility will be required to perform such as moving a power pole, supporting a pole or underground cable, etc.

4. Requests for field location and identification of utilities.

B. Overhead Utilities: The Contractor shall use extreme caution to avoid a conflict, contact, or damage to overhead utilities such as power lines, telephone lines, television lines, poles, or other appurtenances during the course of construction of this project.

END OF SECTION

SECTION 01039

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination.
B. Alteration project procedures.
C. Preconstruction conference.

1.2 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion.

C. After Owner occupancy of site, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

D. Contractor will coordinate all work activities with the Montana Department of Fish, Wildlife and Parks Engineer Kenneth Phillips. P.E..

1.3 PRECONSTRUCTION CONFERENCE

A. Engineer will schedule a conference after Notice of Award is issued.

B. Attendance Required: Engineer, Contractor and the Regional Fish, Wildlife and Parks representative when possible.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, Schedule of Values, and progress schedule.
5. Designation of personnel representing the parties in Contract, and the Engineer.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
7. Scheduling.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance and control of installation.

B. References

1.2 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding?

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.3 REFERENCES

A. Montana Public Works Standard Specifications – Current edition.

B. Should specified reference standards conflict with Contract Documents, or Regulations request clarification for Architect/Engineer before proceeding.

C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

END OF SECTION

SECTION 01560

TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pollution Control

B. Traffic Control

1.2 RELATED SECTIONS

A. Section 01010 - Summary of Work

B. Section 01039 - Coordination and Meetings

1.7 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.8 TRAFFIC CONTROL

A. Provide all temporary signing, personnel and traffic control devises as required by federal, state and local regulations.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART I GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Substitutions.

1.2 PRODUCTS

A. Products: Means new material, components, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

1.3 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place on sloped supports, above ground.

C. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

D. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

1.5 SUBSTITUTIONS

A. Engineer will consider requests for Substitutions only within 15 days after date established in Notice to Proceed.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that the Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty for the Substitution as for the specified product.

3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:

1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.

2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.

3. The Engineer will notify Contractor, in writing, of decision to accept or reject request.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Adjusting.

D. Project record documents.

1.2 CLOSEOUT PROCEDURES

A. Notify the Engineer within 5 days of Work completion that Work is complete in accordance with Contract Documents and ready for Project Manager's final inspection.

B. Provide submittals to Engineer that are required by governing or other authorities or Owner.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. Include Certificate of Substantial Completion, Affidavit on Behalf of the Contractor, Consent of Surety Company to Final Payment and As-built drawings and specifications.

D. Owner will occupy all portions of the site.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean equipment and fixtures to a sanitary condition.

C. Clean site, rake clean landscaped areas, leave all disturbed areas relatively smooth with no wheel tracks, ridges or ruts.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.

4. Change Orders and other Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and Modifications.

E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2. Field changes of dimension and detail.

3. Details not on original Contract drawings.

4. Product substitutions or alternates utilized.

5. Changes made by Addenda and Modifications.

F. Submit documents to Engineer with claim for final Application for Payment.

1.5 WARRANTIES

A. All work shall be warranted free from defect for a period of 10 years from final inspection date.

END OF SECTION

SECTION 02230

STREET EXCAVATION, BACKFILL AND COMPACTION

REFERENCE IS MADE TO THE MONTANA PUBLIC WORKS STANDARD SPECIFICATIONS WITH THE FOLLOWING CHANGES.

PART 1: GENERAL

1.3 DENSITY CONTROL TESTING

C. Material Submittals

1. Engineer will provide gradation test results to contractor for his use to obtain compaction.

PART 3: EXECUTION

3.1 EXECUTION

B. Stockpile the respective road mix, clay liner, and general fill material in separate stockpiles for later re use. Avoid mixing the material as little as possible. If contractor contaminates the road mix or clay liner, he will provide replacement material at no additional costs to the owner.

PART 4: MEASUREMENT AND PAYMENT

A. EXCAVATION ABOVE SUBGRADE

4. Payment is lump sum and is paid under either Slump Repair or Liner replacement bid items.

B. SUBEXCAVATION/REPLACEMENT BELOW SUBGRADE

2. Payment is lump sum and is paid under either Slump Repair or Liner Replacement bid items.

C. EMBANKMENT IN PLACE

3. Payment is lump sum and is paid under either Slump Repair or Liner Replacement bid items.

END OF SECTION

SECTION 02276

POLYETHYLENE GEOMEMBRANE

PART 1 GENERAL REQUIREMENTS

1.1 SCOPE

The following describes parameters for the manufacture, supply, and installation of polyethylene geomembranes. All products, operations, and methods shall be in strict accordance with the Engineer's specifications, plans, and drawings and manufacturer's recommendations.

1.2 QUALIFICATIONS OF CONTRACTOR WORK ACTIVITIES

1.2.1 MANUFACTURING

The manufacturer shall meet the National Sanitation Foundation Standard 54 requirements for Flexible Membrane Liners, and shall have at least five (5) years continuous experience in the manufacture of polyethylene geomembrane and/or experience totaling 10,000,000 square feet of manufactured polyethylene geomembrane.

1.2.2 INSTALLATION

The installation contractor shall be the manufacturer or an approved contractor trained and licensed to install the manufacturer's membrane.

Installation shall be performed under the constant direction of a field installation supervisor who shall remain on site and be responsible, throughout the liner installation, for liner, layout, seaming, patching, testing, repairs, and all other activities by the Contractor. The field installation supervisor shall have installed or supervised the installation and seaming of a minimum of 2,000,000 square feet of polyethylene geomembrane and be certified by the liner manufacturer. Seaming shall be performed under the direction of a master seamer (who may also be the field installation supervisor) who has seamed a minimum of 2,000,000 square feet of polyethylene geomembrane, using the same type of seaming apparatus specified for this project. The field installation supervisor and/or master seamer shall be present whenever seaming is performed.

1.3 SUMITTALS

1.3.1 MANUFACTURER

The manufacturer shall provide the following information:

- List of material properties.
- Manufacturing quality control program.
- Copy of Quality control certificates issued by resin supplier.
- Copy of quality control certificates for the geomembranes in conformance with Section 2.4.3.

1.3.2 INSTALLATION CONTRACTOR

The Contractor shall provide the following written information:

- A list of completed facilities, totaling a minimum of 2,000,000 square feet for which the contractor has installed polyethylene geomembrane. For each installation the following information shall be provided:

Name and purpose of the facility, location, and date of installation.
Name of owner, design engineer, manufacturer, and name and telephone number of the contact at the facility who can discuss the project.
Thickness and quantity of the installed geomembrane.

- A Copy of the manufacturer's approval letter(s) and/or license.
- Proposed installation pallet layout.
- Resume' of the field installation supervisor and master seamer.

1.4 WARRANTY

A written warranty shall be obtained from the manufacturer (for material) and the installation contractor (for workmanship). These documents shall warrant both the quality of the material and workmanship for 20 years.

PART 2 MATERIAL SPECIFICATIONS

2.1 MATERIALS

2.1.1 The geomembrane shall be high density Polyethylene.

2.1.2 Gasket material shall be neoprene, closed cell medium, ¼ inch thick, 50 foot lengths with adhesive on one side or other compatible gasket materials as required.

2.1.3 Metal battens or straps and hardware shall be stainless steel.

2.1.4 Water cut-off mastic shall be supplied as required.

2.1.5 Sealant shall be General Electric Silicone RTV 103, or equivalent.

2.2 GEOMEMBRANE RAW MATERIALS

The geomembrane shall be manufactured of polyethylene resins produced in the United States and shall be compounded and manufactured specifically for the intended purpose. The resin manufacturer shall certify each lot for the following properties.
The natural polyethylene resin without carbon black shall meet the following specifications:

Property	**Test Method**	**HDPE Requirements**
Density, g/cc	ASTM D 1505 or ASTM D 792	0.935 – 0.940
Melt index, g/10min.	ASTM D 1238 Condition E	<0.4

2.3 ROLLS

The geomembrane shall be a minimum 22.5 seamless width. Carbon black shall be added to the resin if the resin is not compounded for ultra-violet resistance.
The surface of the smooth geomembrane shall not have any striation, roughness, pinholes or bubbles.
The Geomembrane shall be supplied in rolls. Labels on each roll shall identify the thickness of the material, the length and width of the roll, lot and roll numbers, and name of the manufacturer.
The geomembrane rolls shall meet the specifications as set forth as follows:

Property	Test Method	Nominal Value
Thickness	ASTM D1593	60 Mils
Sheet Density,g/cc	ASTM D 1505	0.95
Melt Index, g/10	ASTM D1238	0.2
Carbon Black Content, %	ASTM D 1603	2.5
Carbon Black Dispersion	ASTM D 3105	A2
Tensile Strength at Yield,ppi	ASTM D 638	165
Elongation at Yield, %	ASTM D 638	15
Property (cont)	**Test Method (cont)**	**Nominal Value**
Elongation at Break (2.0, GL) (2.5, GL)%	ASTM D 638	(900) (720)
Modulus of Elasticity, psi	ASTM D 638	110,000
Tear Strength, lbs	ASTM D 1004	50
Low Temperature Brittleness	ASTM D 746	<-112°F
Environmental Stress Crack Resistant Hours	ASTM D 1693 (cond B)	200+
Dimensional Stability. %	ASTM 1204	+/-0.5
Roll Width (feet)		22.5
Roll Length (feet)		250
Roll Area (sf)		9000
Weight (lbs)		2710

PART 3 – GEOMEMBRANE

3.1 MATERIALS LOGISTICS

3.1.1 Transportation and On-Site Storage

The geomembrane rolls shall be shipped by trailer truck to job site. A full truckload consists of 16 rolls. The geomembrane shall be stored so as to be protected from puncture, dirt , grease, moisture and excessive heat. The damaged material shall be stored separately for repair or replacement. The rolls shall be stored on a prepared smooth surface (not wooden pallets) and should not be stacked more than two rolls high.

3.2 EARTHWORK

3.2.1 General

Prior to liner installation the subgrade shall be compacted in accordance with the project specifications. Weak or compressible areas which cannot be satisfactorily compacted should be removed and replaced with properly compacted fill. All surfaces to be lined shall be smooth, free of all foreign and organic material, sharp objects, or debris af any kind. The subgrade shall provide a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. Standing water or excessive moisture shall not be allowed.

The Contractor, on a daily basis, shall approve the surface on which the geomembrane will be installed. After the supporting soil surface has been approved, it shall be the Contractor's responsibility to indicate to the Engineer any changes to its condition that may require repair work.

3.2.2 Vegetation Controls

The Contractor, if deemed necessary by the engineer, shall sterilize the area using an effective soil sterilant shall not be harmful to the liner and shall be applied according to the recommendations of its manufacturer.

3.2.3 Anchor Trench

The anchor trench shall be excavated to the line, grade and width shown on the project construction drawings, prior to liner system placement. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the geomembrane.

3.3 METHOD OF PLACEMENT

The rolls shall be deployed using a spreader bar assembly attached to a loader bucket. The Contractor Shall be responsible for the following:

1. Equipment or tools shall not damage the geomembrane during handling, transportation and deployment.
2. Personnel working on the geomembrane shall not smoke or wear damaging shoes.
3. The method used to unroll the panes shall not cause scratches or crimps in the geomembranes and shall not damage the supporting soil.
4. Adequate loading (e.g. sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by the wind (in case of high winds, continuous loading is recommended along the edges of panels to minimize risk of wind flow under the panels).

3.3.1 Weather Conditions

Geomembrane deployment shall proceed between ambient temperatures of 32°F to 104°F. Placement can proceed below 32° only if it has been verified by the engineer that the material can be seamed according to the specification. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g. fog, rain, dew) or in the presence of excessive winds, as determined by the installation supervisor.

3.4 FIELD SEAMING

Approved seaming processes are hot shoe fusion and extrusion welding. On side slopes seams shall be oriented in the general direction of the maximum slope, i.e oriented down, not across the slope. In corners and odd shaped geometric locations, the number of field seams shall be minimized.

No base T-seam shall be closer than 5 feet from the toe of the slope. Seams shall be aligned with the least possible number of wrinkles and “fishmouths”. If a fishmouth or wrinkle is found, it shall be relieved and cap stripped.

3.4.1 Seam Overlap

Geomembrane panels must have a finished minimum overlap of 4 inches for hot shoe fusion welding and 3 inches for extrusion welding.

Cleaning solvents may not be used unless the product is approved by the liner manufacturer.

3.4.2 Seaming Equipment and Accessories

Approved equipment for field seaming are hot shoe fusion welders and extrusion fillet welders.

1. Hot Shoe Welder, 110 Volt (220Volt).
2. Extrusion Welder, 220 Volt, 19 Amps.
3. High Speed, 10,000 rpm, 41/2 inch side grinder with 80 grit discs.
4. Vacuum Box Test Equipment for non-destructive seam testing.
5. Air pressure test equipment for non-destructive seam testing.

6. Field Tensiometer, capable of performing quantitative shear and peel tests.

3.4.3 Test Seams

Field test seams shall be conducted on the liner to verify that seaming conditions are satisfactory. Test seams shall be conducted at the beginning of each seaming period and at least once each 4 hours, for each seaming apparatus and personnel used that day. All test seams shall be made in contact with the subgrade. Welding rods used for extrusion welding shall have the same properties as the resin used to manufacture the geomembrane. The test seam samples shall be 10 feet long for hot shoe welding and 3 feet long for extrusion welding with the seam centered lengthwise. Five specimens shall be cut from each end of the test seams by the Engineer. The Engineer shall use a tensiometer to test 5 specimens for shear and 5 specimens for peel. Each specimen be one inch wide with a grip separation of 4 inches plus the width of the seam. The seam shall be centered between the clamps. The rate of grip separation shall be 2 inches per minute. Test results for seam strength properties shall be the average of five specimens. Fourout of five specimens shall pass seam acceptance criteria. Sheer and peel test shall result in Film tearing Bond (FTB) as defined by NSF Std. 54, which is a failure in ductile mode of one of the bonded sheets by tearing prior to complete separation in the bonded area. If a test seam fails to meet field seaming specifications, the seaming apparatus and/or seamer shall not be used for seaming until the deficiencies are corrected and a successful test seam is achieved.

3.4.4 Non-Destructive Testing

The Contractor shall non-destructively test all field seams over their full length.

A. Vacuum Box Testing

Equipment for testing extrusion seams shall be comprised of the following:

1. A Vacuum box assembly consisting of a rgid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole valve assembly, and a vacuum guage.
2. Soapy solution in a plastic bucket with a mop.

The following procedures shall be followed by the Contractor.

1. Excess sheet overlap shall be trimmed away.
2. Wet a strip of geomembrane approximately 12 inches by length of box with the soapy solution.
3. Place the box over the wetted area and compress.
4. Create a vacuum of 3 to 5 psi.
5. Ensure that a leak tight seal is created.
6. For a period of approximately 15 seconds, examine the geomembrane through the viewing window for the presence of animated soap bubbles.
7. If no animated bubbles appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum of 3” overlap and repeat the process.
8. Al areas where animated soap bubbles appear shall be marked and repaired and then retested.

The following procedures shall apply to locations where seams cannot be non-destructively tested.

1. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.

2. If the seam cannot be tested prior to final installation, the seams shall be spark tested according to the spark tester's manufacturer's procedures.

3.4.5 Destructive Seam Testing

Destructive seam testing should be minimized to preserve the integrity of the liner. The Contractor shall provide the Engineer with one destructive test sample per 500 feet of seam length from a location specified by the Engineer.

A. Sampling Procedure

In order to obtain test results prior to completion of liner installation, samples shall be cut and marked by the Contractor as the seaming progresses. The Contractor shall also record the date, location, and pass or fail description. All holes in the geomembrane resulting from obtaining seam samples shall be immediately patched and vacuum tested.

B. Size and Disposition of Samples

The samples shall be 12 inches wide by 36 inches long with the seam centered lengthwise. The sample shall be cut into three equal length pieces, one to be given to the Engineer, one to be given to the owner and one to be given to the Contractor.

C. Field Laboratory Testing

The Contractor shall test ten 1 inch wide specimens from his sample, five specimens for shear strength and five specimens for peel strength. To be acceptable, four out of the five specimens must pass the project seam requirements.

D. Independent Laboratory Testing

The owner, at his discretion and expense, may send seam samples to a laboratory for testing. The test method and procedures to be used by the independent laboratory shall be the same as used in field testing.

E. Procedures for Destructive Testing

The following procedures shall apply whenever a sample fails the field destructive test:

1. The Contractor shall cap strip the seam between the failed location and any passed test locations.
2. The Contractor can retrace the welding path to an intermediate locations (usually 10 feet from the location of the failed test), and take a sample for an additional field test. If this test passes, then the seam shall be cap stripped between that location and the original failed location. If the test fails then the process is repeated.
3. Over the length of seam failure, the Contractor shall either, cut out the old seam, reposition the pane and reseam, or add a cap strip.

3.4.6 Defects and Repairs

All seams and non-seam areas of the geomembrane shall be inspected by the Engineer for defects, holes, blisters, undispersed raw materials, and any sign of the contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection.

A. Evaluation

Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate in the presence of the Engineer. Each location that fails the non-destructive testing shall be marked by the Engineer and repaired accordingly.

B. Repair Procedures

1. Defect seams shall be cap stripped or replaced.
2. Small holes shall be repaired by extrusion welding. If the hole is larger than ¼ inch it shall be patched.
3. Tears shall be replaced by patching. Where the tear is on a slope or an area

susceptible to stress and has a sharp end it must be rounded prior to patching.

4. Blisters, large cuts and undispersed raw materials shall be repaired by patches.

5. Patches shall be done by extrusion welding. The weld area shall be ground no more than 10 minutes prior to welding. No more than 10% of the thickness shall be removed by grinding. Welding shall commence where the grinding started and must overlap the previous seam by at least 2 inches. Reseaming over an existing seam without regrinding shall not be permitted. The welding shall restart by grinding the existing seam and re-welding a new seam.

Patches shall be round or oval in shape, made of the same geomembrane, and extend a minimum of six inches beyond the edge of defects.

3.5 BACKFILLNG OF ANCHOR TRENCH

The anchor trench shall be backfilled by the Contractor. Trench backfill material shall be placed and compacted in accordance with the project specifications.

Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane. If damage occurs, it shall be repaired prior to resuming backfilling.

3.6 GEOMEMBRANE ACCEPTANCE

The Contractor shall retain all ownership and responsibility for the geomembrane until acceptance by the owner. Final acceptance is when all of the following conditions are met:

1. Installation is finished
2. Verification of the adequacy of all field seam and repairs, including associated testing, is complete.
3. All liner installation equipment, unused liner and debris are removed form the site.
4. All manufacturer's and Contractor's written warranties are received by the Engineer.

END OF SECTION

SECTION 02375

CELLULAR CONFINEMENT SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cellular confinement system for slope protection of hatchery pond walls.

1.2 RELATED SECTIONS

A. Section 02300 - Earthwork.

B. Section 02315 - Excavation and Fill: Infill material.

C. Section 02330 - Embankment.

D. Section 02276 – Polyethylene Geomembrane.

1.3 REFERENCES

A. ASTM D 1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.

B. ASTM D 1603 - Standard Test Method for Carbon Black In Olefin Plastics.

C. ASTM D 5394 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

D. ASTM D 5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

E. US Army Corps of Engineers (USACE) Technical Report GL-86-19, Appendix A.

1.4 SUBMITTALS

A. Comply with Section 01600 – Materials and Equipment.

B. Product Data: Submit manufacturer's product data and installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, cell depth, and system components.

D. Samples: Submit manufacturer's sample of geocells.

E. Certificate of Compliance: Submit manufacturer's certificate of compliance indicating geocells comply with specified requirements.

F. Quality Assurance Certification: Submit manufacturer's ISO 9001:2000 quality assurance certification.

G. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer's Field Representative Qualifications: Experienced in cellular confinement system installation.

B. Installer's Qualifications: Experienced in cellular confinement system installation.

C. Pre-installation Meeting: Convene pre-installation meeting 2 days before start of installation of geocells. Require attendance of parties directly affecting work of this section, including Contractor, Engineer, installer, and manufacturer's representative. Review preparation, installation, and coordination with other work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened pallets and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. GeoProducts, LLC, 8615 Golden Spike Lane, Houston, Texas 77086; toll free (800) 434-4743; phone (281) 820-5493; fax (281) 820-5499; web site www.geoproducts.org; or approved equal.

2.2 CELLULAR CONFINEMENT SYSTEM

A. Model: EnviroGrid EGA204PT-29.

1. Cell Depth: 100 mm (4.0 inches).
2. Nominal Expanded Cell Size: 259 mm (10.2 inches) wide by 224 mm (8.8 inches) long.
3. Nominal Expanded Cell Area: 289 cm^2 (44.8 square inches).Nominal Expanded Section: 2.56 m (8.4 feet) wide by 6.52 m (21.4 feet) long.

4. Cells per Section: 8 cells wide by 29 cells long.
5. Nominal Expanded Section Area: 16.7 m^2 (180 square feet).
6. Weld Spacing: 446 mm plus or minus 3 mm (17.5 inches plus or minus 0.12 inch).

D. Material Properties:
1. Material: Virgin, non-thermally degraded, high-density polyethylene (HDPE).
2. Polymer Density, ASTM D 1505: 0.95 – 0.965 g/cm^3 (58.4 – 60.2 lb/ft^3).
3. Environmental Stress Crack Resistance, ASTM D 5394 >400 hours.
4. Minimum Carbon Black Content, ASTM D 1603: 1.5 percent by weight.
5. Nominal Sheet Thickness, ASTM D 5199: 1.25 mm (50 mils) plus 10 percent, minus 5 percent if smooth or 1.5 mm (60 mils) plus 10 percent, minus 5 percent if textured.
6. If textured the polyethylene strip shall be textured with a multitude of rhomboidal (diamond shape) indentations. The rhomboidal indentations shall have a surface density of 22 to 31 per cm^2 (140 to 200 per in^2).

7. Seam Peel Strength, USACE Technical Report GL-86-19, Appendix A:
   a. Cell Depth 100 mm (4.0 inches): 1,420 N (320 pounds).

8.. Seam Hang Strength: 102-mm (4.0-inch) weld joint supporting load of 72.5 kg (160 pounds) for 30 days minimum or for 7 days minimum while undergoing temperature change from 23 degrees C (74 degrees F) to 54 degrees C (130 degrees F) on 1-hour cycle.

E. Cell Wall: Perforated.
1. Horizontal Rows: 10-mm diameter holes, 16.6 mm on center.
2. Stagger horizontal rows and separate 8.3 mm relative to hole centers.
3. Edge of Cell Wall to Nearest Edge of Perforations: 7.93 mm.
4. Centerline of Weld to Nearest Edge of Perforations: 27.9 mm minimum.
5. Perforations Remove: 12 percent plus or minus 1 percent of cell wall area.

G. Section Length 21.4”.

H. Color: Black with Carbon Black
1. Fascia Strips: N/A

2.3 ACCESSORIES

A. J-Hooks:
1. Material with sufficient strength to support and anchor geocells.
2. Steel Reinforcing Bars: Uncoated
   a. Diameter: 0.500 inch

b. Length: 2’ feet

c. Hook: 90-degree bend

2.4 INFILL MATERIAL

A Infill Material: Granular fill USCS CH existing fill.

2.5 OTHER GEOSYNTHETIC COMPONENTS

A. Nonwoven Geotextiles: Not used in this project

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine area to receive geocells. Notify Engineer if area is not acceptable. Do not begin preparation or installation until unacceptable conditions have been corrected.

3.2 PREPARATION

A. Prepare site by removing key material, remove liner, remove slumped material, separate materials into their respective stockpiles.

B. Regrade the pond walls.

C. Complete earthwork, including toe-in trenches when required for slope or channel lining applications, as specified in Section 02300.

3.3 INSTALLATION

A. Install geocells in accordance with manufacturer's instructions at locations indicated on the drawings.

B. Anchor geocell sections as necessary to resist sliding due to gravitational forces and sheet flow.

C. Ensure top edges of adjoining cell walls are flush with each other and in proper alignment.

D. Deliver infill material to geocells from top of slope or channel to bottom in accordance with manufacturer's instructions.

E. Limit drop height of infill material to a maximum of 1 m (3 feet) to prevent damage to

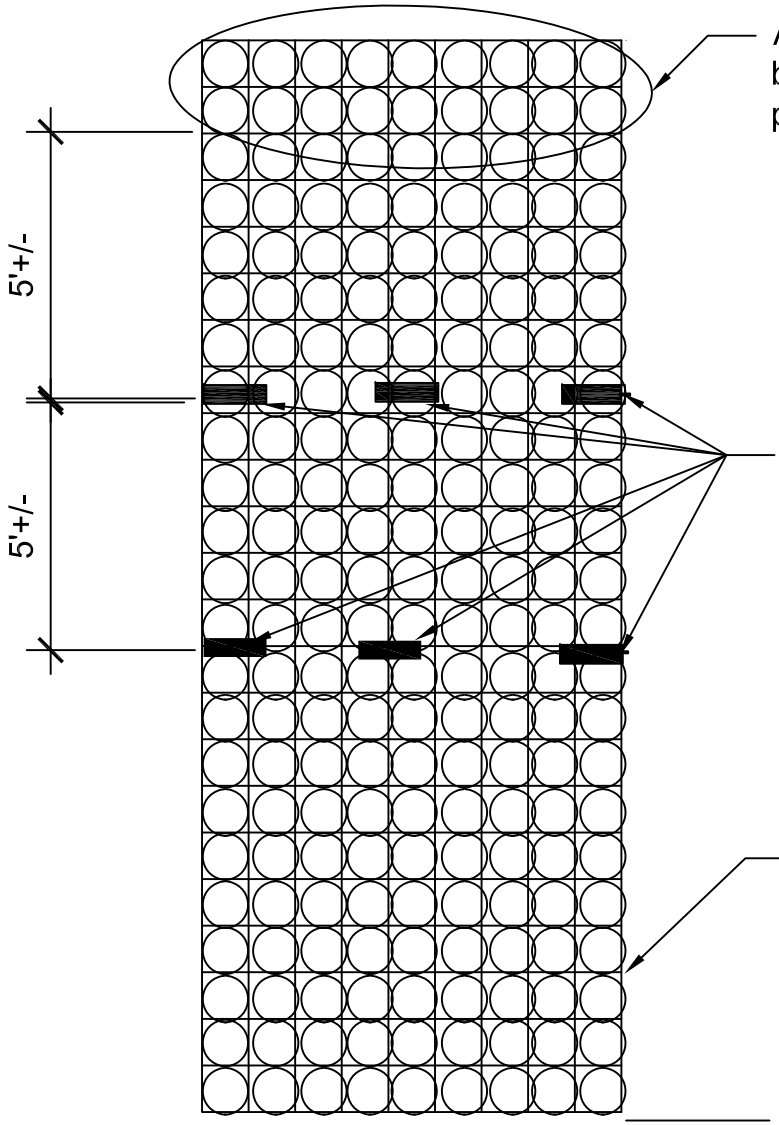
geocells.

F. Overfill expanded geocell sections by 25 to 50 mm (1 to 2 inches) to allow for settling and compaction, when using granular infill materials.

G. Compact granular infill materials to top of geocells to a minimum of 95 percent SPDD.

END OF SECTION

Section 02375 5 Pages



Anchor Stake
2' long #4 rebar field bent w/ a 90° hook at top.

K Phillips 7/2012 DRAWN BY: DATE: CHECKED BY: DATE:	REVISED BY: DATE: APPROVED BY: DATE:	APPROVED BY: DATE: APPROVED BY: DATE:	Montana Fish, Wildlife & Parks	Hatchery Liner Replacement Miles City Hatchery 7113103	SHEET: 1 of 1

Miles City Hatchery Liner Repairs

PROJECT PHOTOS

Pond 18 Liner Replacement

Pond 20 Liner Replacement

Pond 20 slump

Pond 26 Slump

Pond 28 Slump